PUBLIC DOCUMENT . . . . . No. 55.

ANNUAL REPORT

OF THE

INSPECTOR

OF

Gas Meters and Illuminating Gas.

JANUARY, 1900.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
18 POST OFFICE SQUARE.
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Commonwealth of Massachusetts.

Office of Inspector of Gas and Gas Meters,
32 Hawley Street, Boston, Mass., Jan. 30, 1900.

Hon. Wm. M. Olin, *Secretary of the Commonwealth.*

Sir: — I have the honor to hand you herewith the annual report of the Inspector of Gas Meters and of Illuminating Gas for 1899.

Respectfully,

CHAS. D. JENKINS.

REPORT.

Office of Gas Inspection, 32 Hawley Street,
Boston, Mass., Jan. 29, 1900.

To the Honorable Senate and the House of Representatives.

The Inspector of Gas Meters and of Illuminating Gas submits the following annual report:—

During the year ending Dec. 31, 1899, there were 687 gas inspections made, 30,445 gas meters inspected, 5 meter provers graduated, and a number of gas analyses made, in addition to the regular office work.

A gas inspection usually comprises the determination of the candle-power, the amount of total sulphur and ammonia, and the presence or absence of sulphuretted hydrogen; these determinations are at times supplemented by eudiometric analysis. In the case of oil gases the candle-power and sulphuretted hydrogen tests are made, but the sulphur and ammonia tests are omitted, owing to the exceedingly small quantities, if any, of these impurities present. The standard of gas is given in section 14, chapter 61, Public Statutes; the light or candle-power must be equal to sixteen standard English candles, and the gas must not contain more than twenty grains of sulphur or ten grains of ammonia per hundred cubic feet, or any sulphuretted hydrogen.

The gas supplied by the 69 companies in the State was tested at regular intervals by the inspector or assistant inspector, no notice whatever being given of an intended inspection. Three of these companies, Middleborough, Wakefield and Westfield, are under municipal control. The number of inspections made and the averages of results obtained are given in the following tables. At its request, these results were furnished to the Board of Gas and Electric Light Commissioners from time to time during the year.

Larger Companies.

Number of Inspections made.	NAME OF PLACE OR COMPANY.	CANDLE-POWER.			GRAINS PER ONE HUNDRED FEET OF GAS OF —	
		Average.	Highest.	Lowest.	Sulphur.	Ammonia.
52	Boston,	25.44	27.2	23.3	8.91	1.—
7	Brockton,	17.13	21.3	13.9	14.90	1.—
52	Brookline,	25.46	28.1	20.7	9.13	1.—
37	Cambridge,	17.69	19.3	16.4	15.04	1.—
21	Charlestown,	19.21	21.0	16.5	12.68	1.—
7	Chelsea,	17.77	19.0	16.5	14.64	1.97
34	Dorchester,	25.48	26.7	23.7	8.81	1.—
10	East Boston,	18.09	19.1	17.1	9.89	1.76
22	Fall River,	22.20	25.7	18.2	6.47	1.—
5	Fitchburg,	17.98	21.0	14.5	14.18	1.—
6	Gloucester,	18.77	19.7	18.1	14.48	1.—
16	Haverhill,	24.34	27.9	20.2	9.51	1.—
12	Holyoke,	18.78	19.8	17.1	12.07	7.44
14	Jamaica Plain,	17.29	18.9	13.4	14.58	3.77
18	Lawrence,	19.96	21.6	18.5	12.00	1.—
51	Lowell,	21.39	23.8	18.9	10.38	1.—
26	Lynn,	19.62	20.7	18.5	12.29	1.45
12	Malden,	18.41	20.1	16.9	13.35	1.—
13	New Bedford,	20.16	21.2	19.3	11.73	1.—
17	Newton,	18.34	19.5	17.4	13.29	1.—
8	North Adams,	19.14	20.9	17.6	10.09	3.81
5	Northampton,	18.80	19.4	17.8	15.60	9.52
4	Pittsfield,	26.55	27.8	25.2	4.90	1.—
36	Roxbury,	24.94	26.9	21.3	8.69	1.—
9	Salem,	18.12	19.0	17.4	13.39	1.88
20	South Boston,	25.35	27.1	24.3	9.85	1.—
23	Springfield,	20.03	22.1	18.7	13.03	1.—
9	Taunton,	17.99	18.7	16.2	7.76	21.00
6	Waltham,	17.90	18.9	16.4	8.08	6.90
38	Worcester,	20.66	21.7	19.1	11.12	1.—
	Average,	20.43	–	–	11.36	2.52

Smaller Companies.

Number of Inspections made.	NAME OF PLACE OR COMPANY.	Candle-power.	Grains per One Hundred Feet of Gas of —	
			Sulphur.	Ammonia.
3	Adams,	23.63	7.73	1.—
3	Amesbury,	21.50	8.73	1.—
3	Arlington,	19.63	10.93	1.—
2	Athol,	21.55	5.90	1.—
4	Attleborough,	16.75	11.07	2.50
3	Beverly,	18.90	11.77	1.33
3	Chicopee,	21.93	5.90	1.—
3	Clinton,	15.50	16.43	1.—
2	Danvers,	16.90	9.90	2.70
3	Dedham,	18.43	10.80	1.57
2	Easthampton,	19.55	14.25	3.20
3	Framingham,	19.67	7.37	1.—
2	Greenfield,	19.15	7.10	9.15
2	Ipswich,	27.60	8.20	1.—
2	Marblehead,	17.60	10.80	1.—
3	Marlborough,	17.70	12.90	1.—
3	Milford,	17.93	6.60	3.17
2	Nantucket,	17.30	8.45	14.95
2	Natick,	18.35	12.25	1.—
3	Newburyport,	19.03	11.23	1.—
4	North Attleborough,	17.12	11.32	1.—
2	Norwood,	18.95	9.10	1.30
2	Plymouth,	17.80	8.05	15.95
3	Quincy,	18.40	10.77	2.07
2	Southbridge,	23.95	13.70	1.—
3	Spencer,	23.99	7.47	1.—
2	Stoneham,	22.50	5.70	1.—
2	Wakefield,	19.40	13.95	1.60
2	Ware,	19.70	9.30	6.25
2	Webster,	19.00	8.85	1.—
3	Westfield,	19.33	7.10	1.—
3	Woburn,	18.93	10.77	1.—
	Average,	19.61	9.82	2.53

Companies making Gas from Petroleum.

Number of Inspections made.	NAME OF PLACE OR COMPANY.	Candle-power.
2	Amherst,	43.90
2	Gardner,	49.05
2	Leominster,	27.95
2	Lexington,	26.45
2	Middleborough,	27.45
2	Stoughton,	59.85
2	Williamstown,	52.15
	Average,	40.97

Various interesting comparisons are given in the following table: —

	1899.	1898.	1897.	1896.	1895.
All companies but oil gas: —					
Average candle-power,	20.01	20.14	19.71	19.07	19.30
Average sulphur, grains per 100 cubic feet.	10.57	9.61	9.54	8.85	9.29
Average ammonia, grains per 100 cubic feet.	2.52	2.06	2.29	1.79	2.46
Average candle-power: —					
Coal gas, 36 companies,	18.23	18.43	17.92	17.61	18.03
Water gas, 16 companies,	23.88	23.72	23.66	22.77	23.28
Mixed coal and water gases, 10 companies.	20.22	20.21	19.79	19.39	19.65
Petroleum oil gas, 7 companies.	40.97	38.02	38.11	35.41	33.00

At Gloucester, Marblehead, Stoneham and Williamstown part or all of the tests were made at the works, as being the most available places.

The violations of the law last year numbered 64, — rather more than usual. The details are given in the following tables: —

Deficient Candle-power.

[Legal standard, 16 minimum.]

Number of Inspections.	PLACE.	Date.	Amount.
4	Attleborough,	Dec. 29,	14.8
7	Brockton,	Feb. 11,	14.8
–	Brockton,*	July 8,	14.0
–	Brockton,*	Sept. 14,	13.9
3	Clinton,	Nov. 3,	11.4
5	Fitchburg,	Dec. 8,	14.5
14	Jamaica Plain,	Oct. 10,	13.4

* Consecutive.

Excess of Sulphur (Grains per 100 Cubic Feet).

[Legal standard, 20 grains maximum.]

Number of Inspections.	PLACE.	Date.	Amount.
7	Brockton,*	July 8,	23.8
–	Brockton,*	Sept. 14,	26.2
–	Brockton,*	Nov. 3,	21.3
37	Cambridge,†	April 25,	23.3
–	Cambridge,†	June 21,	27.5
–	Cambridge,†	Nov. 4,	22.4
–	Cambridge,†	Dec. 20,	21.2
21	Charlestown,	June 13,	21.3
7	Chelsea,	Dec. 22,	31.9
3	Clinton,	Nov. 3,	26.5
6	Gloucester,	June 14,	20.9
12	Holyoke,	Oct. 7,	22.7
14	Jamaica Plain,‡	June 13,	23.9
–	Jamaica Plain,‡	Aug. 12,	24.6
17	Newton,	Dec. 7,	20.1
5	Northampton,	June 29,	24.6
9	Salem,	Sept. 19,	24.3

* Consecutive. Fine due the city. † Not consecutive. ‡ Consecutive.

Excess of Ammonia (Grains per 100 Cubic Feet).

[Legal standard, 10 grains maximum.]

Number of Inspections.	PLACE.	Date.	Amount.
12	Holyoke,*	Feb. 21,	13.3
–	Holyoke,*	March 15,	16.7
–	Holyoke,	Oct. 26,	22.2
14	Jamaica Plain,*	May 12,	10.8
–	Jamaica Plain,*	June 13,	10.8
2	Nantucket,	Sept. 9,	28.6
2	Greenfield,	Jan. 26,	13.9
8	North Adams,	July 13,	11.0
5	Northampton,	March 15,	33.3
2	Plymouth,	March 31,	29.4
9	Taunton,*	March 8,	11.6
–	Taunton,*	May 10,	15.5
–	Taunton,†	Oct. 11,	14.2
–	Taunton,†	Nov. 4,	66.7
–	Taunton,†	Dec. 15,	62.3
6	Waltham,	Nov. 14,	10.4

* Consecutive. † Consecutive. Fine due the city.

Sulphuretted Hydrogen present.

[Legal standard, none allowed.]

Number of Inspections.	PLACE.	Date.
3	Adams,	Dec. 6.
3	Amesbury,*	March 29.
–	Amesbury,*	Oct. 5.
–	Amesbury,*	Dec. 15.
3	Arlington,	Nov. 17.
2	Athol,†	April 7.
–	Athol,†	Dec. 6.
21	Charlestown,‡	Oct. 19.

* Consecutive. Fine due the town.

† With previous inspection, three consecutive. Fine due the town.

‡ Consecutive.

Sulphuretted Hydrogen present — Concluded.

Number of Inspections.	PLACE.	Date
–	Charlestown,*	Nov. 3.
3	Clinton, ...	Nov. 3.
22	Fall River, ...	Jan. 10.
12	Holyoke,†	Oct. 7.
–	Holyoke†, ...	Nov. 15.
14	Jamaica Plain, ...	Nov. 23.
51	Lowell, ...	Dec. 2.
2	Nantucket, ...	June 24.
8	North Adams, ...	Oct. 25.
4	Pittsfield,†	Jan. 27.
–	Pittsfield†, ...	Sept. 27.
2	Plymouth, ...	March 31.
3	Spencer, ...	Sept. 29.
2	Stoneham, ...	Nov. 18.
2	Lexington, ...	Nov. 17.
2	Stoughton, ...	Nov. 29.

* Consecutive. † Not consecutive.

The determination of total sulphur in gas is a strictly chemical operation, and requires scientific apparatus and skill in its use not generally possessed by a gas works manager. Although, for this reason, it is not practicable to watch the amount of sulphur present in the gas as it is being distributed, still, seventeen excesses in one year would indicate the need of more or better purification. As sulphuretted hydrogen is easily removed from gas, and more easily detected, there can be no excuse for its presence but carelessness or broken or insufficient apparatus for removing it.

The following table is of the eudiometric analyses which were made for various reasons. The first two are of low

candle-power coal gas, the third of medium candle-power water gas, the second three of coal gas below the standard, the next two of Jamaica Plain gas after taking its supply of gas from the Massachusetts Pipe Line Gas Company. The succeeding fourteen analyses were made in response to the request of the Board of Gas and Electric Light Commissioners.

In this table of analyses the calorific powers are calculated for gas at 60° F. and 30 inches barometer, and include the latent heat of the steam formed; the heat units, on this account, will be from 35 to 50 B. T. U. higher than the usual "net" units.

	Candle-power.	Specific Gravity.	Illuminants.	Marsh Gas.	Hydrogen.	Carbonic Oxide.	Nitrogen.	Oxygen.	Carbonic Acid.	B. T. U. calculated.	Illuminants.
Cambridge, . . .	16.9	–	4.07	34.79	45.82	6.93	6.13	–	2.26	602.0	–
Cambridge, . . .	17.0	–	5.60	34.82	46.72	5.46	5.80	0.12	1.48	629.0	$C_{2.61}H_{4.74}$
Chicopee, . . .	22.2	–	12.61	17.44	33.26	32.29	2.06	–	2.34	633.0	–
Jamaica Plain, . .	13.4	–	3.83	33.03	39.61	6.61	13.95	0.99	1.98	–	–
Fitchburg, . . .	14.5	.397	3.81	34.02	52.66	6.41	2.40	0.17	0.53	–	–
Attleborough, . .	14.8	–	4.83	35.23	51.85	5.30	1.35	0.09	1.35	–	$C_{2.58}H_{3.75}$
Jamaica Plain, . .	18.9	.507	5.75	41.34	38.32	6.78	7.13	–	0.68	724.9	$C_{3.12}H_{8.43}$
Jamaica Plain, . .	17.4	.501	5.92	40.47	38.17	7.22	8.04	–	0.18	676.4	$C_{2.68}H_{5.24}$
Boston, ...	27.1	–	14.83	20.59	32.19	27.25	2.31	–	2.83	691.2	–
Boston, ...	27.0	–	16.13	20.73	31.74	26.60	2.58	–	2.22	714.3	–
Boston, ...	26.2	–	14.33	20.82	32.56	27.44	2.56	–	2.29	684.9	–
Boston, ...	25.0	–	14.07	21.68	33.21	26.91	1.58	–	2.55	689.4	$C_{2.65}H_{4.34}$
Boston, ...	23.3	.582	13.07	19.88	33.59	28.64	2.17	–	2.65	659.4	–
Boston, ...	26.2	–	13.43	19.79	35.26	26.71	2.17	0.03	2.61	661.4	–
Boston, ...	23.9	–	13.09	20.69	32.46	28.85	0.66	0.09	4.16	661.6	–
Brookline, . . .	25.0	–	13.61	19.69	29.83	26.43	6.06	0.16	4.22	654.1	–
Brookline, . . .	26.6	–	13.36	20.58	29.56	25.08	5.99	1.06	4.37	655.3	–
Brookline, . . .	26.9	–	12.49	19.05	30.26	26.48	6.53	0.48	4.71	629.2	–
Brookline, . . .	24.5	–	14.20	20.85	29.15	25.41	6.33	0.29	3.77	674.4	$C_{2.87}H_{5.10}$
Brookline, . . .	26.8	–	14.93	22.30	29.24	25.80	3.43	0.17	4.13	706.1	–
Brookline, . . .	24.4	–	13.43	22.70	29.86	25.25	4.61	0.30	3.85	679.7	–
Brookline, . . .	23.0	.524	8.88	29.98	33.07	17.96	6.95	0.47	2.69	647.6	–

Gas Meters.

During the year 1899 there were 30,445 gas meters inspected; 29,960 were new ones, or those which had just been repaired, and were inspected and sealed, if correct, before being used. A very few required adjustment before passing inspection and being sealed. An interesting comparison, by six months periods, of the number of these meters tested, follows: —

	1899.	1898.	1897.	1896.	1895.
First six months, . .	12,683	9,541	9,172	10,594	12,285
Second six months, .	17,277	13,023	13,512	11,081	15,166

The remaining meters, 485 in number, belong to the class of "complaints." By the provisions of section 12, chapter 61, Public Statutes, "Meters in use shall be tested by the inspector or by his assistant or deputy on the request of the consumer or of the gas light company." Meters so tested are called "complaints," and the results of such tests follow. One meter would neither pass gas nor register; 11 would pass gas, but would not register. The average error of the remaining 473 meters was 0.64 per cent. fast; the law allows a meter to be stamped as correct that does not vary more than 2 per cent. either way from the standard measure. One hundred and ninety-nine meters, 41.04 per cent. of the total number reinspected, were fast, the average error being 4.64 per cent.; 49 meters, 10.10 per cent., were slow, the average error being 13.52 per cent.; 225 meters were correct within the legal limits. Of the fast meters, 118 were between 2 and 5 per cent., 73 between 5 and 10 per cent., 7 between 10 and 15 per cent., and 1 between 15 and 20 per cent. Of the slow meters, 19 were between 2 and 5 per cent., 17 between 5 and 10 per cent., 5 between 10 and 15 per cent., and 1 between 15 and 20 per cent.; and there was 1 each 20, 25, 30, 35, 60, 105 and 160 per cent. slow.

In testing meters, careful attention ought to be paid to temperatures; the temperatures of the meter, the air in the

proving room and the air and water of the prover should not vary more than 2 degrees.

Meters should be set in easily accessible places, and not more than six feet from the floor; this makes it possible for the consumer to frequently read the meter, and to shut off the gas supply in case of need. If consumers would learn to read their gas meters they would be able to know at what rate they were burning gas, and not be obliged to wait for the gas company's bill. To read a gas meter dial, begin at the left and read towards the right the smaller figures, or those the hands have passed; this gives the present "state" of the meter. From this subtract the previous state, and the result is the amount of gas, in hundred cubic feet, that has been used in the interval. More attention should be paid to burners, both for lighting and heating, in order to develop the best results from the gas used, and at the same time not to waste it. A burner recently tested gave, on proper regulation, a candle-power of 23.1 when burning 5 feet of gas; by simply opening the cock and supplying more gas, a candle-power of only 21.2 was developed, although 10.2 cubic feet of gas were being consumed. By using burners of this sort the amount of gas consumed would be more than twice as much as in the first case, and the light actually obtained more than 8 per cent. less.

Chapter 465 of the Acts of 1899, taking effect July 1, provided for an accounting of the fees received from testing meters, and in the following tables the returns appear, together with the other financial statements of the office: —

FINANCIAL STATEMENT.

Salaries: —		
Appropriation,		$3,450 00
Charles D. Jenkins,	$2,250 00	
Lawrence S. James,	1,200 00	
	$3,450 00	
Travelling expenses: —		
Appropriation,		$650 00
Charles D. Jenkins,	$478 21	
Lawrence S. James,	269 16	
	$747 37	

Apparatus and supplies: —		
Appropriation,		$250 00
Adapters for sulphur test,	$99 00	
Two sulphur meters,	65 00	
Glazed meter,	18 00	
Other apparatus,	37 25	
Laboratory supplies,	26 85	
Publications,	2 00	
Candles,	7 50	
	$255 60	

Gas Meter Fees Account, for Six Months ending Dec. 31, 1899.

INCOME.

Number and size of meters, including complaints, and fees for same: —		
23, 2 lights, 10,479, 3 lights, 5,009, 5 lights, at 25 cents,	$3,877 75	
1,302, 10 lights, 393, 20 lights, 112, 30 lights, 17, 45 lights, 42, 50 lights, 13, 60 lights, at 30 cents,	563 70	
2, 70 lights, 12, 80 lights, 28, 100 lights, at 50 cents,	21 00	
10, 150 lights, at 90 cents,	9 00	
3, 200 lights, at $1.25,	3 75	
2, 250 lights, at $1.50,	3 00	
4, 300 lights, at $1.70,	6 80	
		$4,485 00
Of this there has been collected,		2,328 10
Leaving still due,		$2,156 90

EXPENDITURES.

Appropriation,		$1,250 00
Salaries, deputy meter inspectors: —		
T. E. Spear,	$483 33	
E. A. Page,	242 50	
		$725 83

Office expenses: —		
Rent,	$250 00	
Stationery and printing,	19 75	
Postage,	26 85	
Telephone,	30 00	
Telegrams,	52	
Gas,	3 20	
Miscellaneous,	5 22	
		$335 54
Meter expenses: —		
Badging meters,	$104 79	
Travelling,	50 23	
Sealing wax,	25 00	
Brass,	4 99	
		185 01
		$1,246 38
Received for six months,		$2,328 10
Received, due July 1,		50 77
Expended, as per schedule,	$1,246 38	
Turned over to Hon. E. P. Shaw, State Treasurer,	1,132 49	
	$2,378 87	$2,378 87

In addition to above there was expended: —

T. E. Spear, salary, two weeks, at $20,	$40 00	
E. A. Page, salary, eight and a half weeks, at $15,	127 50	
G. N. March, trustee, rent,	50 00	
		$217 50

The deficiency in the travelling expense account is accounted for by the facts of more inspections having been made last year than previously, and more unused mileage tickets having been carried forward to 1900.

The apparatus and supply account was overdrawn at the last of the year on account of both small sulphur meters giving out, and requiring new ones to replace them.

As to the expenditures from meter fees, it became apparent during October that the expenditures for office expenses and meter testing were at a larger rate than the appropriation warranted. An attempt was made to curtail by taking off the second deputy. The large number of meters being

presented for inspection made this seem an undesirable action, and, in order to carry out the provisions of the law regarding meter inspection, the inspector paid the bills appearing in the deficiency list.

In order to improve the work of this office, the inspector would make the following recommendations : —

There should be some relief from the gradually increasing number of gas inspections.

There should be provision made for turning over all fees received for testing meters to the Treasurer and Receiver-General, and also for paying all bills from this account through the Auditor's office, as is the custom with other offices and commissions of the Commonwealth.

There should be more money appropriated for office and other expenses.

In regard to gas inspections, the number made depends on the amount of gas supplied by each company; this has been very generally increasing, so that, with 500 inspections in 1892, there were 687 in 1899. It has required a great deal of overtime work to make these tests, and, with the probable increase this year, it will be impossible to carry out the provisions of the law without relief.*

During the six months of accounting for fees, only absolutely necessary expenditures were made, and even then the amount appropriated, at the rate of $2,500 for the year, was insufficient.

It seems fit and proper that the financial part of the gas inspector's office should go through the offices of Treasurer and Auditor of the Commonwealth, as is the custom with other State offices.

Respectfully submitted,

CHARLES D. JENKINS.

* See Gas Inspector's report, January, 1886, House Document No. 45, page 12.